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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

June 20, 1996

William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

> **Re: Written Ex Parte Communication in
> CC Docket No. 94-54**

Dear Mr. Caton:

On June 20, 1996, the attached written ex parte presentation was forwarded to Michael Wack, Deputy Chief of the Policy Division, Wireless Telecommunications Bureau.

Sincerely,

Mark J. Golden
Vice President, Industry
Relations

cc: w/encl.   Michael Wack
                Rudolfo M. Baca
                Jackie Chorney
                David Siddall
                Suzanne Toller

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JUN 20 1996

FEDERAL COMMUNICATIONS COMMISSION

June 20, 1996

Michael Wack
Policy Division
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W.
Room 5202
Washington, D.C. 20554

>   Re: **CC Docket No. 94-54**

Dear Michael:

Following up on our recent meeting regarding PCS to cellular network roaming arrangements, I am enclosing the following information:

*   TIA Document PN-3212;"Internetworking/Interoperability Between DCS-1900 and IS-41 Based MAPs for 1800 MHz Personal Communications Systems." This standards document received final approval by the TR46 standards committee at its meetings in Ottawa the week of June 3, 1996. It is my understanding that all balloting on the standard is complete and it only awaits final publication.

    This standard discusses implementations in the broadband PCS network that ensure that, from a technical standpoint, roaming PCS subscribers will be indistinguishable to the visited cellular network from roaming cellular subscribers, and that the network interconnection will be completely in accordance with cellular industry standard IS-41 roaming procedures.

*   An excerpt from the June 14, 1996, Bulletin, which covers a press briefing given by Ericsson in Washington on June 10, 1996. At that press briefing, Ericsson discussed the availability of a dual mode PCS/cellular handset within the next quarter (that is, in the July-September time frame).

Michael Wack
June 20, 1996
Page 2

PCI remains committed to the need for cellular carriers
to deal in good faith with PCS carriers seeking roaming
arrangements and that cellular carriers not be permitted to
treat licensed, technically capable PCS carriers differently
than cellular carriers.

Sincerely,

Mark J. Golden
Vice President, Industry
Relations

1 Edited by: Patrick Johnson, NORTEL

TR 46

4 **Interworking / Interoperability Between**

5 **DCS 1900 and IS-41 Based MAP's for**

6 **1800 MHz Personal Communications Systems - Phase I**

7 PN-3212 V&V Revision 0.10

8 Working Document

9 May 2, 1996

Revision History

Revision	Date	Comments
0	02 May 1996	Rev 0, First Version

Interworking / Interoperability Between DCS 1900 and IS-41 Based MAP's for 1800 MHz Personal Communications Systems

Phase I

Table of Contents

1. Introduction

Interworking and interoperability between DCS 1900 MAP and IS-41 MAP systems is a key issue in ensuring national and global availability of Personal Communications Systems (PCS) services for mobile users. National / global availability of PCS services to end users should be understood to mean availability of at least a basic set of PCS services throughout the PCS coverage area, unless limited by:

- subscription
- lack of interworking agreement between the operators of home and visited systems
- terminal capability
- capabilities implemented in the visited system.

To ensure seamless operation of services across dissimilar PCS systems, it is critical that specific interoperability, interconnection, and interworking standards be developed both nationally and internationally

1.1. Scope

This document addresses American National Standards for the functions listed in Section 1.4, which appear to be the centerpiece of the required interworking and interoperability to ensure nationwide and global availability of PCS services.

This document is a TIA Interim Standard (IS) on I & I between DCS 1900 and IS-41 systems operating in the 800 MHz and 1850 - 1990 MHz broadband PCS frequencies.

The network is based on a logical Interworking and Interoperability Function (IIF) which can be implemented in different physical entities. Call flows are proposed which define the mapping between the DCS 1900 MAP and the IS-41 protocol. Data structures within the IIF are not described as these will be maintained inside the IIF and have no impact on the mapping of the DCS 1900 and IS-41 protocols.

1.2 Assumptions

The following assumptions are used in developing the call flows and interworking for I&I.

a.   The national significant digits of the PSISDN and the IS-41 Dialable number (e.g. DN) should be the same number. (In the USA based on the North American Numbering Plan.)

b.   IS-41 and DCS 1900 MAP protocols will not be changed.

c.   Appropriate user access mechanisms will be available.

d.   IS-41 Rev. C is assumed as the base for I&I capability. However, there are many I&I features that operate with IS-41 Rev. B systems. Refer to Informative Appendix A of this document.

e.   DCS 1900 MAP Rev. 0 is assumed.

1.3 Organization

This document is organized as follows:

- Section 2, "References", lists the normative and informative references used in this document.

- Section 3, "Terminology", summarizes the acronyms and definitions used in this document.

- Section 4, "I&I Reference Model", presents a Reference Model derived from the TR46 Network Reference Model, and adapted to clearly illustrate the types of interfaces possible in the PCS interconnection environment.

- Section 5, "Teleservices I&I", details the standards associated with PCS teleservices interoperability and interworking.

- Section 6, "Supplementary Services I&I", details the standards associated with PCS supplementary services interoperability and interworking.

1.4 Interworking and Interoperability Functional Outline

The functions specified for interworking or interoperability or both include the following:

1) Location Management:

    Registration;

    Authentication;

    Location Update;

2) Subscriber Data Management:

    Call Data Recording;

    Provisioning;

3) Call Handling:

    Call Origination;

    Call Termination;

4) Supplementary Services:

    Automatic Recall

    Automatic Reverse Charging

    Call Forwarding

    Call Hold and Retrieve

    Call Transfer

    Call Waiting

    Calling Number Identification Presentation

1   Calling Number Identification Restriction

2   Conference Calling

3   Flexible Alerting

4   Intercept Access Service

5   Message Waiting Notification

6   Multi-Way Calling (MWC)

7   Multi-level Precedence & Preemption (MLPP)

8   Priority Access and Channel Assignment

9   Reverse Charging

0   Short Message Service

1   Smart Card

2   Voice Privacy Service

3   5)   Intersystem (DCS1900/IS41) Handoff;

4

2. References

This document contains both normative and informative references. The normative references are considered a part of the standard, while informative references are provided as additional documentation made available to the reader, on an information only basis. The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. ANSI and TIA maintain registers of currently valid national standards published by them.

2.1. Normative References

1. IS-652 PCN to PCN Intersystem Operations based on DCS 1900,

2. TIA/EIA Interim Standard IS-41 Revision C

2.2. Informative References

1. TIA TR46, IS-104 A, Personal Communications Services Descriptions

2. TIA TR46, PN-3167, Personal Communications Systems Requirements

3. TIA/EIA, IS-53-A, Cellular Features Description, May 1995

3. Terminology

3.1. Acronyms

AC	Authentication Center
Ack	Acknowledge
ANSI	American National Standards Institute
AUTHREQ	Authentication Request
AUX	Auxiliary Services
BSC	Base Station Controller
BTS	Base Transceiver Station
CFB	Call Forwarding on Busy
CFNA	Call Forwarding on No Answer
CFNR	Call Forwarding on Not Reachable
CFU	Call Forwarding Unconditional
CKSN	Ciphering Key Sequence Number
CL	Cancel Location
CNIP	Calling Number Identification Presentation
CW	Call Waiting

1	DCS 1900	
2	DMH	Data Message Handler
3	DN	Directory Number
4	EIR	Equipment Identity Register
5	ESN	Electronic Serial Number
6	GPCSC	Gateway PCSC
7	GSM	Global System for Mobile Communications
8	GT	Global Title
9	HLR	Home Location Register
0	IAM	Initial Address Message
1	I&I	Interworking and Interoperability
2	IIF	Interworking and Interoperability Function
3	IMEI	International Mobile Equipment Identification
4	IMSI	International Mobile Subscriber Identity
5	IS	Interim Standard
6	ISD	Insert Subscriber Data
7	ISDN	Integrated Services Digital Network
8	ISUP	ISDN User Part
9	IWF	Interworking Function
0	LOCREQ	Location Request
1	MAP	Mobile Application Part
2	MIN	Mobile Identification Number
3	MSC	IS-41 based Mobile Switching Center
4	NE	Network Element
5	OS	Operations Support
6	P&A	Privacy & Authentication
7	PCN	Personal Communications Network
8	PCS	Personal Communications Services
9	PCSC	DCS 1900 PCS Switching Center
0	PLMN	Public Land Mobile Network
1	PRN	Provide Roaming Number
2	PS	Personal Station
3	PSISDN	Personal Station ISDN Number
4	PSPDN	Packet Switched Public Data Network
5	PSRN	Personal Station Roaming Number
6	PSTN	Public Switched Telephone Network

1	QUALREQ	Qualification Request
2	RAND	Random Number
3	REDREQ	Redirection Request
4	REGCANC	Registration Cancellation
5	REGNOT	Registration Notification
6	ROUTREQ	Routing Request
7	SCCP	Signaling Connection Control Part
8	SP	Signaling Point
9	SRI	Send Routing Information
0	SS	Supplementary Service
1	SS7	Signaling System Number 7
2	SSD	Shared Secret Data
3	TCAP	Transaction Capabilities Application Part
4	TLDN	Temporary Local Directory Number
5	TRANUMREQ	Transfer to Number Request
6	UL	Update Location
7	VLR	Visitor Location Register
8		

3.2. Definitions

For the purposes of this Standard, the following definitions apply.

Network Interworking — is defined as functional mapping of services and protocols across interfaces between two dissimilar networks (some services may not be delivered or delivered in a different way). From a protocol perspective, this function can be performed on one layer or on multiple layers. Since interworking can be performed on any layer, but not necessarily all layers, the preservation of all functional capabilities cannot be assumed.

Network Interoperability — is defined as the direct mapping of similar functions and/or services across dissimilar networks. Interoperability implies uniform functionality between network elements

Seamless Service — From a user's perspective, the operation of a wireless telecommunications service within a home service provider area, within a visited service provider area and between multiple service provider areas is identical.

Interface — The boundary or point of connection between two adjacent physical or logical entities. This boundary establishes the technical interface, the test points and the points of operational responsibility of the two entities. The boundary is defined in communications systems by functional, interconnection and signaling characteristics.

Point of Interface (POI) — A reference point of interface between two network elements.

Trunk — A transmission channel connected between two network elements in a telecommunications system.

DCS 1900 Subscriber — A Subscriber whose home network is DCS 1900 and who has a DCS 1900 service profile defined by subscription in the home network. For the purpose of I&I when the subscriber is roaming into an IS-41 network, the DCS 1900 subscriber also has an IS-41 service profile, used by the visited network.

IS-41 Subscriber — A Subscriber whose home network is IS-41 and who has a IS-41 service profile defined by subscription in the home network. For the purpose of I&I when the subscriber is roaming into a DCS 1900 network, the IS-41 subscriber also has a DCS 1900 service profile used by the visited network.

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4. I&I Reference Model

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Figure 4-1 illustrates the I&I Reference Model, which has been developed to assist in the understanding of all appropriate interconnection and interoperability issues. This reference model was developed from TR46's Network Reference Model, as described in PN-3169
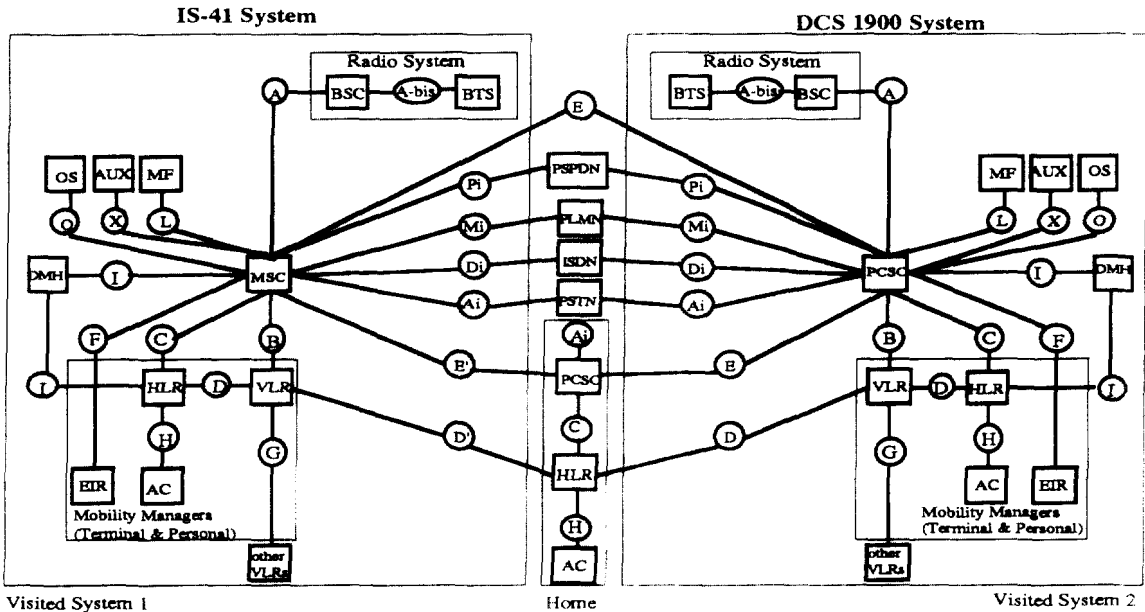

IS-41 System   **DCS 1900 System**

Visited System 1   Home   Visited System 2

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7
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Figure 4-1 Systems Interconnection Scenario

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4.1 Interworking and Interoperability Functional Reference Models

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The IIF is designed to be generic for interfaces between carriers, i.e., its use is not precluded for any network reference points. A specific network interface type is primarily defined by the signaling method or protocol used and the signaling information provided via the signaling protocol.

6

The IIF is intended to satisfy the following criteria:

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1)   support a wide variety of telecommunications services;

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2)   support network interfaces which can be symmetrical;

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3)   support interface types which take advantage of Signaling System Number 7.

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The high-level I&I functional reference model is shown in Figure 4-2. This model describes the overall I&I concept. All I&I implementations can be logically derived from this model. The detailed I&I functional reference model is shown in Figure 4-3.

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The IIF can be implemented as an internal or external function. That is, the function may reside external to both the DCS 1900 and IS-41 networks or it may reside within the DCS 1900 network, the IS-41 network or both.
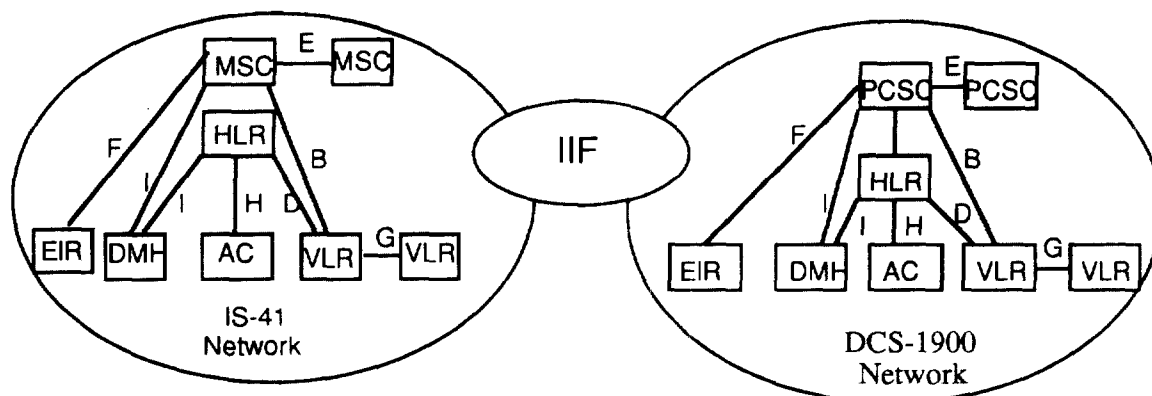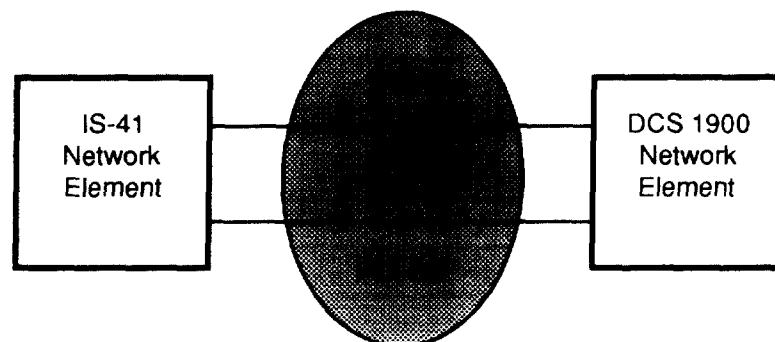
Figure 4-2 High-level Reference Model for IS-41/DCS-1900 Interworking and Interoperability

The detailed I&I functional reference model is shown in Figure 4-3. It can be applied to any of the B, C, D, E, F, G, H and I interface reference points, and may be extended to other interface reference points of the model in Figure 4-1. This interface model is consistent with the TIA TR46 Network Reference Model.

POI-T: Trunk Point of Interface
POI-SM: SS7/MAP Point of Interface

Figure 4-3   Detailed Functional Reference Model for IS-41/DCS 1900 Interworking and Interoperability

Interfaces between the network elements are defined in terms of the following Points of Interface (POIs):

- Trunk Point of Interface (POI-T);

- SS7/MAP Point of Interface (POI-SM)

4.1.1.1 The POI-T interface is designed to convey trunk user traffic.

The POI-T interface is a trunk circuit from an IS-41 PCS network element to a DCS 1900 PCS network element.

4.1.1.2 SS7/MAP Point of Interface (POI-SM)

The POI-S interface is designed to convey SS7 Common Channel Signaling traffic supporting the IS-41 MAP and DCS 1900 MAP protocols.

The SS7 Point of Interface is an SS7 signaling link between an IS-41 PCS network element Signaling Point (SP) and a DCS 1900 PCS network element SP.

1

4.1.2 Alternative scenarios of IIF placement

Four alternative scenarios of IIF placement / deployment can be derived from
the higher-level I&I Functional Reference Model.

4.1.2.1 Scenario 1: IIF Resides within DCS 1900 Network

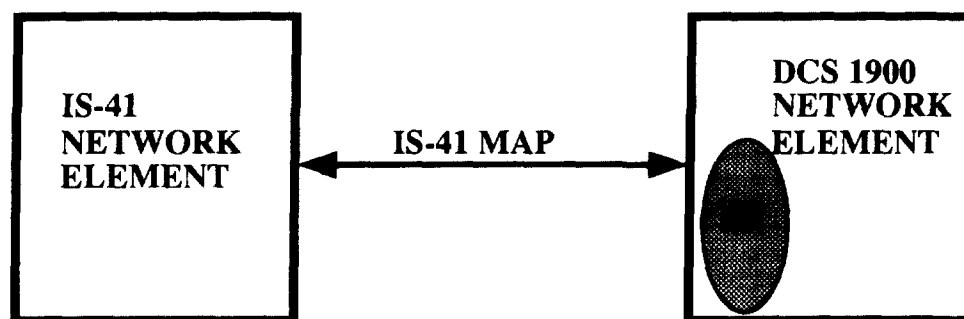This scenario is illustrated by the figure below

Figure 4-4 The IIF resides within DCS 1900

In this scenario, the IIF resides entirely within the DCS 1900 NE(s) from
which communication by one or more IS-41 network elements is necessary for
I&I. (Reference Appendix C Figure C-4)

By definition, the IS-41 MAP is the application level protocol for
communication between the IS-41 and DCS 1900 network elements.

1

2   **4.1.2.2 Scenario 2:   IIF Resides within the IS-41 Network**

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4   This scenario is illustrated by the figure below and is the converse of Scenario
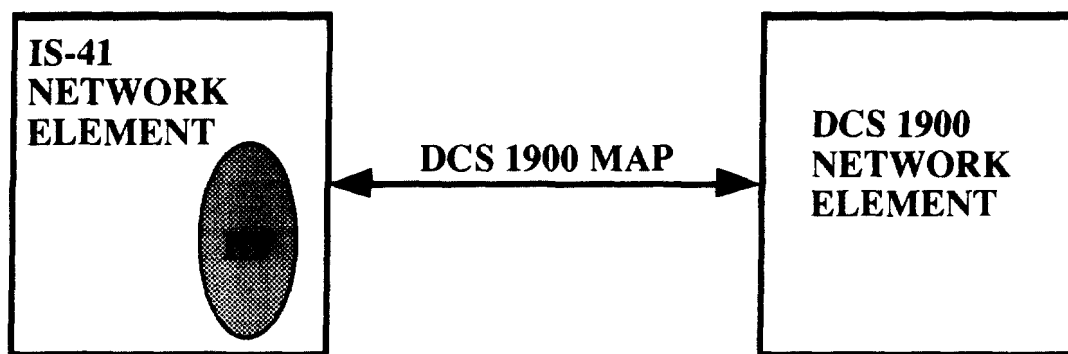5   1.

8   **Figure 4-5   The IIF resides within IS-41**

9

0   In this scenario the IIF resides entirely within the IS-41 NE(s) from which
1   communication by one or more DCS 1900 network elements is necessary for
2   I&I. (Reference Appendix C Figure C-3)

3

4   By definition, the DCS 1900 MAP is the application level protocol for
5   communication between the DCS 1900 and IS-41 network elements.

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2   **4.1.2.3 Scenario 3:   IIF Resides within an External Element**

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4   This scenario is illustrated by the figure below.

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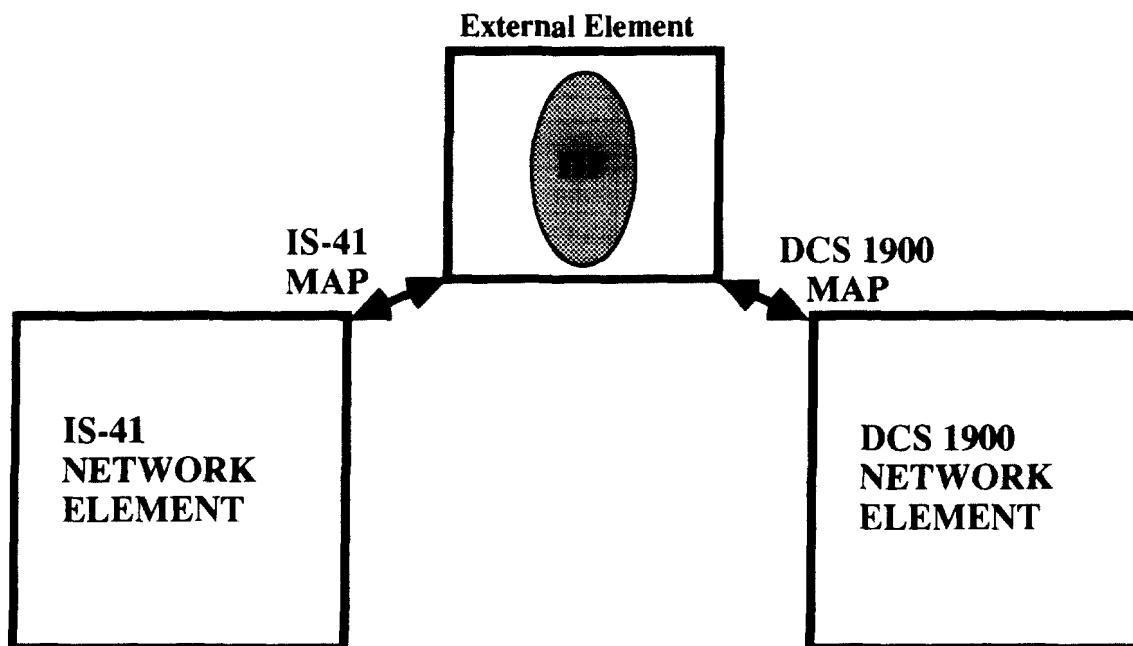7
8   **Figure 4-6   The IIF resides within an External**
9   **Element**

0   In this scenario the IIF resides within an element external to the IS-41 NE(s)
1   and the DCS 1900 NE(s) between which communication is necessary for I&I.
2   (Reference Appendix C Figure C-2)

3   By definition, the IS-41 MAP is the application level protocol for
4   communication between the IS-41 NE and the External Element containing the
5   IIF.

6   By definition, the DCS 1900 MAP is the application level protocol for
7   communication between the DCS 1900 NE and the External Element
8   containing the IIF.

1

2　　　**4.1.2.4 Scenario 4: IIF Resides within both IS-41 and DCS**
3　　　**1900 Networks**

4

5　　　This scenario is illustrated by the figure below
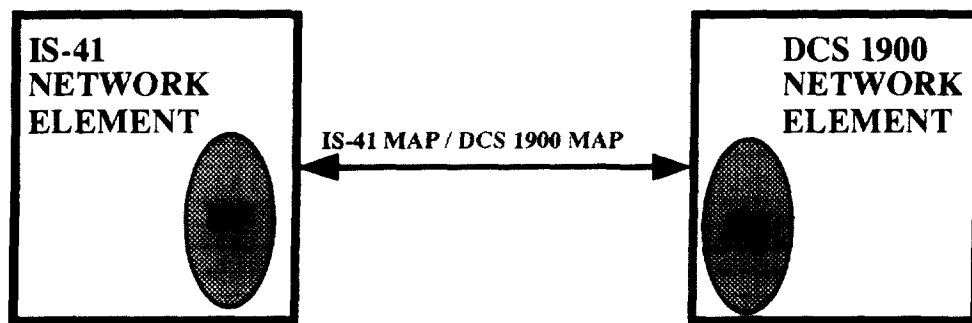

6
7
8　　　**Figure 4-7　The IIF resides within both IS-41 and**
9　　　**　　　　　　　DCS 1900**

0

1　　　In this scenario the IIF resides within both the IS-41 network element and the
2　　　DCS 1900 network element between which communication is necessary for
3　　　I&I. It is understood that the IIF within the IS-41 network element complement
4　　　the IIF within the DCS 1900 network element; i.e. IIFs are required in both of
5　　　the communicating IS-41 and DCS 1900 network elements to ensure I&I.

6　　　In this scenario the application level protocol for communication between the
7　　　IS-41 and DCS 1900 network elements is not restricted to either the IS-41
8　　　MAP or the DCS 1900 MAP.

9

5. TeleServices Interoperability

5.1 Voice Services

Notation Used within the Information Flow Diagrams
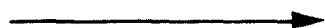
Network / Functional Entities

PS	Personal Station
RS	Radio System
MSC	IS-41 Mobile Switching Center
PCSC	PCS Switching Center
VLR	Visitor Location Register
PCSC/VLR	Network entity with colocated /combined PCSC and VLR functions (note DCS 1900 system)
HLR	Home Location Register
AC	Authentication Center
HLR-IIF	Interworking & Interoperability functionality coupled with one or more HLRs, which includes

IS-41 HLR, DCS 1900 HLR and DCS 1900 AC capability.

Bold font is used to designate an IS-41 network entity (e.g. **MSC**)

Italic font is used to designate a DCS 1900 network entity (e.g. *PCSC/VLR*).

Bold, Italic font is used for the HLR-IIF (e.g. ***HLR-IIF***)

Information Flows

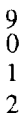⟶ IS-41 MAP and DCS 1900 MAP message

⟹ Call Setup

Message Names

1   Upper case (e.g. AUTHENTICATION_REQUEST) is used for MAP-level
2   Invocation.

3   Lower case (e.g. authentication_request) is used for MAP-level Return
4   Result/Return Error.

5   Mixed upper and lower case (e.g. Channel_Request) is used for messages over
6   the Air, A, and other non MAP-level interfaces.

a. On the initial registration attempt by a subscriber (DCS 1900 or IS-41) moving from a DCS 1900 system to an IS-41 system, the serving IS-41 MSC sends the AUTHREQ to the VLR which subsequently sends the AUTHREQ to the HLR-IIF using the MIN and ESN.

b. The HLR-IIF forwards the AUTHREQ to the IS-41 AC.

c. The IS-41 AC determines that the PS is allowed access and returns an authreq to the HLR-IIF

d. The HLR-IIF returns an authreq to the Serving IS-41 VLR and subsequently to the MSC.

e. The Serving IS-41 MSC sends a REGNOT to the VLR using the MIN (PSISDN) associated with PS. The Serving IS-41 VLR determines that the PS is unknown and sends a REGNOT to the HLR/IIF.

f. The HLR-IIF initiates a Cancel Location (CL) to the previous VLR/PCSC. Note: It is not intended to fix a specific order between the sending of CL and regnot.

g. The HLR-IIF determines that authorization can be granted to the PS and returns the requested information in the regnot to the Serving IS-41 VLR and subsequently to the MSC

h. The previous VLR/PCSC acknowledges the removal of the subscriber from the VLR with a Cancel Location Ack.

When a Subscriber (DCS 1900 or IS-41) moves from an IS-41 system to another IS-41 system, the message flow is similar to Figure 5-1, with the exception that Cancel_Location transaction (steps f and h) is replaced with a Registration_Cancellation transaction to the previous IS-41 system.